International Effects of Monetary and Fiscal Policy in a Liquidity Trap

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The Economics of Liquidity Traps

• Interest generally has been restricted to one country, or small open economies
• But last two years see episode of global liquidity traps
• Fall 2008 – most major policy rates fell to near zero
  – Unconventional monetary policy – limited use
• With continuing recession – need for fiscal expansion
2008-2009 Policy Rates

- US
- EuroZ
- UK
- Can
- Jap
<table>
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<th>2009</th>
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<td>5.9</td>
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Key question

• How does global dimension affect the effects of fiscal policy?
• Standard reasoning – fiscal leakages
• Therefore, fiscal stimulus needs to be coordinated
• Seen as doubly important in liquidity trap
This paper

• Explores the determination of liquidity trap in international (2 country) model
  – How do LT’s propagate?

• Explores fiscal response
  – How much leakage is there in LT?
  – How does it depend on who is in a liquidity trap
  – How does it depend on monetary policies elsewhere?

• Explores nature of optimal fiscal response when both countries are in liquidity trap
  – Need for coordinated response?
  – Balance between monetary and fiscal policy?
Recent literature

• Krugman (1999)
• Svensson (2001)
• Eggertsson and Woodford (2003, 2005)
• Eggertson (2009)
• Jung et al. (2005)
• Fujiwara et al. (2009), (2010)
• Jeanne (2010)
• Bodenstein et al. (2010)
Basic Model

• Follows
  – Clarida Gali Gertler 2002
  – Engel, 2010
  – Beetsma and Jensen 2005

• Emphasize importance of home bias
  – Faia and Monacelli 2008
Results

• LT contagion is determined by financial markets and preferences
  – Linkages ‘Wicksellian’ real interest rates
  – Absence/presence of ‘home bias’ in preference
  – With integrated financial markets and ID preferences, LT is immediate and global

• Fiscal leakage theory is absent in LT
  – Fiscal policy response is beggar thy neighbor
  – Fiscal multiplier is *larger* in open economy LT
  – In LT for one country, depends on ER policy of ROW
Results

• Coordinated response is very close to that of closed economy response
  – No free lunch
  – LT in one country mostly dealt with by domestic policy
  – With monetary commitment, optimal fiscal response almost zero
Basic model

• 2 country – endogenous fiscal policy, home bias in preferences

\[ U_t = E_0 \sum_{t=0}^{\infty} (\beta)^t (U(C_t, \xi_t) - V(H_t, z_t) + J(G_t)) \]

where \[ C_t = \Phi C_{Ht}^{v/2} C_{Ft}^{1-v/2}, \ v \geq 1 \]

and

\[ C_H \text{ and } C_F \] Differentiated with elasticity \( \theta \)
Basic model

- Household consumes public goods supplied using lump-sum taxes
- Household receives preference shocks which cause fluctuations in the natural real interest rate
- Financial markets are complete
  - could be relaxed
Household optimality

- Labor supply
  \[ U_C(C_t, \xi_t) W_t = P_t V' (H_t, z_t) \]

- Risk-sharing
  \[ U_C(C_t, \xi_t) = U_C(C^*_t, \xi^*_t) T_{t}^{\nu-1} \]

  - Note that preference shocks cause consumption reallocation, in addition to real exchange rate movements
Price setting: conventional

• Linear technology

\[
\tilde{P}_{Ht}(i) = \frac{\theta}{\theta - 1} (1 - s_t) \frac{E_t \sum_{j=0}^{m_{t+j}\kappa^j \frac{W_{t+j}}{A_{t+j}} Y_{t+j}(i)}}{E_t \sum_{j=0}^{m_{t+j}\kappa^j Y_{t+j}(i)}}
\]

\[
P_{Ht} = [((1 - \kappa)\tilde{P}_{Ht}^{1-\theta} + \kappa P_{Ht-1}^{1-\theta})] \frac{1}{1-\theta}
\]
Monetary policy

• No markup shocks here, PCP, and optimal subsidies removes monopoly distortion

• ZLB is the only possible deviation from 1st best

\[ R_t = \max(\tilde{R}_t^r, 1) \]

• Monetary policy should replicate `Wicksellian’ interest rate
  – if it can
Fiscal Policy

• There is an optimal size of government here

\[ J_G(\tilde{G}_t)A = V'(\tilde{N}_t, z_t) \]

• How much should we deviate from this in face of ZLB?
Flexible price equilibrium

• Consumption responses

\[
\tilde{C}_t = \frac{1}{\sigma} \left(1 - \frac{\phi c_y}{\phi + \sigma}\right) \varepsilon_t^W + \frac{1}{\sigma} \left(1 - \frac{\phi c_y (1-v)^2}{\Delta}\right) \varepsilon_t^R
\]

\[
\tilde{C}_t^* = \frac{1}{\sigma} \left(1 - \frac{\phi c_y}{\phi + \sigma}\right) \varepsilon_t^W - \frac{1}{\sigma} \left(1 - \frac{\phi c_y (1-v)^2}{\Delta}\right) \varepsilon_t^R
\]
Flexible price equilibrium

• Interest rate responses

\[ \tilde{r}_t = \bar{r} + \left( \frac{\phi c_y}{\phi + \sigma} \varepsilon_t^W + \frac{\phi c_y(v-1)}{\Delta} \varepsilon_t^R \right)(1 - \mu) \]

\[ \tilde{r}_t^* = \bar{r} + \left( \frac{\phi c_y}{\phi + \sigma} \varepsilon_t^W - \frac{\phi c_y(v-1)}{\Delta} \varepsilon_t^R \right)(1 - \mu) \]

• When home-bias is zero, optimal interest rates are identical
• So if we hit LT, we do so simultaneously
More generally interest rates depart from one another as $v$ rises.
When prices are sticky

- Inflation equations

\[ \pi_{Ht} = k(\phi \hat{n}_t + \]  
\[ \frac{\sigma}{2c_yD} \left[ \hat{n}g_t (1 + D) + \hat{n}g_t^* (D - 1) \right] ) + \beta E_t \pi_{Ht+1} \]  

Depends on output gaps and fiscal policy gaps

\[ \hat{n}g_t = (\hat{n}_t - (1 - c_y) \hat{g}_t) \]
When prices are sticky

• Euler equations

\[ E_t(\hat{n}g_{t+1} - \hat{n}g_t)(D + v - 1) + E_t(\hat{n}g^*_{t+1} - \hat{n}g^*_t)(D - (v - 1)) \]

\[ = \frac{2c_yD}{\sigma} E_t \left( r_t - \tilde{r}_t - \pi_{Ht+1} - (1 - \frac{v}{2}) \frac{\sigma((\hat{n}g_{t+1} - \hat{n}g^*_{t+1}) - (\hat{n}g_t - \hat{n}g^*_t))}{c_yD} \right) \]

Note: the only shock is to the flexible price real interest rate
Now

• Let us contrast the impacts of shocks when the interest rate is positive to those in a liquidity trap

• Under a positive interest rate, assume a Taylor rule

\[ r_t = \bar{r} + \gamma \pi H_t \]

• Let the shocks be AR(1) with persistence \( \mu \)
First, look at the case $v = 1$

- Then the savings shock is identical in the two countries

$$\hat{n}_t(Taylor) = \frac{(1-\beta \mu)\bar{r}_t}{\Delta_1}$$

- A savings shock causes a fall in desired real interest rate, and a fall in GDP in both countries
Fiscal Policy Responses

• Response to a domestic fiscal expansion
  – Positive, but less than in a closed economy

\[
\hat{n}_t^{g(Taylor)} = \hat{n}_t^{g(Closed)} - \frac{\kappa \phi c_y (\sigma-1)(\gamma-\mu) \Delta_0}{2\Delta_1\Delta_2} \hat{g}_t
\]

  – Because fiscal expansion causes a TOT appreciation

\[
\hat{\tau}_t^{g(Taylor)} = -\frac{\phi k (1-c_y)(\gamma-\mu) \hat{g}_t}{\Delta_2}
\]
Consumption also falls

\[ \hat{g}^g_{t(Taylor)} = -\frac{\phi k(1-c_y)(\gamma-\mu)\hat{g}}{2\Delta_1} \]

- So therefore, multiplier must be less than unity

\[ \hat{n}_t = c_y (\hat{c}_t + \frac{1}{2}\hat{\tau}_t) + (1 - c_y)\hat{g}_t \]
International Spillovers

• Fiscal expansion increases foreign output, for \( \sigma > 1 \)

\[
\hat{h}_t^{g(Taylor)} = \frac{(1-c_y)\kappa \phi c_y (\sigma-1)(\gamma-\mu)\Delta_0}{2\Delta_1\Delta_2} \hat{g}_t^* 
\]

– Foreign TOT depreciation offsets fall in C
Now assume that $\tilde{r}_t$ falls below zero

- Taylor rule cannot apply – set nominal interest rate to zero
- Assume following dynamic

- At time $t$ \[ \tilde{r}_t = \tilde{r}_L < 0 \]

- time $t'>t$ \[ \tilde{r}_t = \tilde{r}_L \text{ w. prob } \mu \]
  \[ \tilde{r}_t = \bar{r} \text{ w. prob } 1 - \mu \]
Again, focus on $v=1$ case

\[
\hat{n}_t^{r}(\text{ZLB}) - \hat{n}_t^{r}(\text{Taylor}) = \frac{\gamma \kappa c_y (\sigma + \phi c_y) (1-\mu)(1-\beta \mu) \tilde{r}_t}{\Delta_1 \Delta_3} > 0
\]

\[
\Delta_3 = \sigma (1 - \beta \mu)(1 - \mu) - \mu k (\sigma + \phi c_y)
\]
Magnification effect

• Fall in demand – fall in $\pi$, which raises real interest rate, further fall in demand
• If $\Delta_3 > 0$, this process converges
• This puts an upper limit on persistence of the ZLB shock
• If $\mu=1$, then indeterminacy
Fiscal policy at ZLB

- Terms of trade depreciation

\[
\hat{\tau}^g_{t(ZLB)} = \frac{\mu \phi k (1-c_y)(\hat{g}_t - \hat{g}_t^*)}{\Delta_4}
\]

- Consumption rises

\[
\hat{C}^g_{t(ZLB)} = \frac{\mu \phi k (1-c_y)(\hat{g}_t + \hat{g}_t^*)}{2\Delta_3}
\]
Why does TOT move in opposite direction?

• Fiscal expansion raises domestic inflation rate

\[ E_t (\pi_{Ht+1} - \pi_{Ft+1})^g_{t(ZLB)} = \]

\[ \frac{(1-c_y)(1-\mu)\mu\phi}{\Delta_4} (\hat{g}_t - \hat{g}_t^*) \]
To satisfy interest rate parity, need anticipated TOT appreciation

\[ 0 - E_t \pi_{Ht+1} = \]

Domestic inflation rises a lot, reducing Home PPI RIR

\[ 0 - E_t \pi_{Ft+1} + \left(1 - \frac{v}{2}\right) E_t (\hat{\tau}_{t+1} - \hat{\tau}_t) \]

Foreign inflation falls, raising foreign PPI RIR

So need an anticipated TOT appreciation
Output effects

• Since TOT depreciates, and C rises, from goods market equilibrium
  – multiplier must be greater than unity

\[ \hat{n}_t = c_y(\hat{c}_t + \frac{1}{2} \hat{r}_t) + (1 - c_y)\hat{g}_t \]

  – May be much larger (see later)
International Spillovers?

• Foreign TOT appreciates, but C rises
  – For $\sigma>1$, the first effect offsets the second
  – Foreign output falls

$$\hat{n}_t^* = c_y (\hat{C}_t - \frac{1}{2} \hat{\tau}_t) + (1 - c_y) \hat{g}_t^*$$

  – Fiscal expansion in home country is `beggar thy neighbor’
Comparison with closed economy

• Fiscal leakages
  – With Taylor rule, as we saw,

\[
\hat{n}_{t(Taylor)}^g = \hat{n}_{t(Taylor)}^g(\text{Closed}) - \frac{\kappa\phi c_y(\sigma-1)(\gamma-\mu)\Delta_0}{2\Delta_1\Delta_2} \hat{g}_t
\]

  – So ‘leakages’ are positive, and fiscal expansion less effective
Comparison with closed economy

• Under ZLB, leakages are negative
  – The increase in TOT leads multiplier to be greater in the open economy

\[
\hat{n}^g_{t(ZLB)} - \hat{n}^g_{t(ZLB-closed)} = \frac{(1-c_y)k\phi c_y \mu (\sigma-1) \Delta 5 \hat{g}_t}{\Delta 3 \Delta 4} > 0
\]

  – But obviously, this can only happen by drawing demand away from foreign country
General case (with home bias)

• Domestic negative demand shock leads to a greater fall in domestic desired real interest rate
• Home country `enters’ liquidity trap first
• Foreign country may or may not be in LT
• Quantitative evaluation of multipliers
Calibration: standard

<table>
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<th>( \beta )</th>
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Case $v=1$ – No Home bias

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<th>Variable</th>
<th>Flexible PI</th>
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<th>Global Liq</th>
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<td>-0.04</td>
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Case v>1 – Home bias – multipliers are higher under Taylor rule, but smaller under LT

<table>
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<tr>
<th>Variable</th>
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<th>Global Liquidity Trap</th>
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Case $v>1$ – LT in home economy - asymmetry

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<td>-0.08</td>
</tr>
<tr>
<td>Foreign Real IR</td>
<td>-0.03</td>
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</table>
But what is foreign wasn’t IT’ing

- Say it targets its exchange rate..
- e. g. Say foreign follows an exchange rate target

\[ r_t^* = \bar{r} + \gamma \pi_{Ft}^* - \delta(s_t - s_{t-1}) \]

\[ = \bar{r} + \gamma \pi_{Ft}^* - \delta(\tau_t - \tau_{t-1} - (\pi_{Ft}^* - \pi_{Ht})) \]
Dampens TOT effects: Spillovers +

<table>
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<th>Variable</th>
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<td>Home Consumption</td>
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<td>Foreign Consumption</td>
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<td>Home Real IR</td>
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<tr>
<td>Foreign Real IR</td>
<td>-0.088</td>
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Optimal Monetary and Fiscal Policy

• How should optimal policy respond in face of a LT shock?
• Assume optimal cooperative policy
  – (maximize sum of discounted utilities)
• First: optimal discretionary policy
  – With $v=1$, then both countries can then only use fiscal policy – monetary policy is useless
2\textsuperscript{nd}-O Approximation of EU (case v=1)

\begin{align*}
V_{(v=1),t} &= -\left(\hat{n}_t - \hat{n}_t^*\right)^2 \frac{(1+\phi c_y)}{2c_y^2} - \left(\hat{n}_t + \hat{n}_t^*\right)^2 \frac{(\sigma+\phi c_y)}{2c_y^2} \\
&\quad - \left(\hat{g}_t - \hat{g}_t^*\right)^2 \frac{(1-c_y)((1-c_y)+c_y\sigma)}{2c_y^2} - \frac{(1-c_y)}{2c_y^2} (\sigma (\hat{g}_t + \hat{g}_t^*)^2 \\
&\quad - 2((\hat{n}_t - \hat{n}_t^*)(\hat{g}_t - \hat{g}_t^*) + \sigma(\hat{n}_t + \hat{n}_t^*)(\hat{g}_t + \hat{g}_t^*)) \\
&\quad - \frac{\theta}{k} \pi^2 H_t - \frac{\theta}{k} \pi^2 F_t
\end{align*}
Note

• There is a cost to having government spending deviate from its desired level (Beetsma-Jensen)

• But there may be a benefit in terms of stabilizing output

• Optimal policy has \( g = g^* \neq 0 \) during LT
  – After LT, \( g = g^* = 0 \), and all gaps closed

• Not optimal with commitment
The optimal fiscal response

- Government spending countercyclical

\[
\hat{g}_t = -\varepsilon_t \frac{\phi c_y ((1-\beta \mu) + k\theta (\sigma + \phi c_y))}{\Delta_6}
\]

- Optimal output gap

\[
\hat{n}_t = -\frac{\sigma (1-\beta \mu) - \theta k\phi (1-c_y)\hat{g}_t}{((1-\beta \mu) + k\theta (\sigma + \phi c_y))}
\]
Fiscal policy does act as stabilizer

• Output gap is lower than under passive fiscal policy
• How does the international dimension affect the optimal fiscal policy?
• Recall
  – Own multiplier is greater
  – Foreign multiplier less
• When $v=1$, cancel out, and fiscal policy is exactly as in a closed economy
More general case – extend welfare function to $v>1$ case

- Optimal Fiscal Response is aggressive, but domestically focused
- In case where home country is in LT only, foreign country optimal fiscal policy is very limited
- Response of Home is almost same even if foreign doesn’t participate
- With Global LT precipitated by Home, foreign participates, but much less
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<th>Table 3</th>
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<th>Global LT</th>
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<tr>
<td>Home output</td>
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<tr>
<td>Foreign output</td>
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<tr>
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<tr>
<td>Foreign fiscal</td>
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<td>0</td>
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<tr>
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<td>-2.1</td>
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<tr>
<td>Foreign inflation</td>
<td>-0.3</td>
<td>-0.71</td>
</tr>
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<tr>
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<td>Fiscal Response</td>
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<td>Home output</td>
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<td>Foreign output</td>
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<tr>
<td>Home fiscal</td>
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<tr>
<td>Foreign inflation</td>
<td>-0.28</td>
<td>-0.7</td>
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Monetary commitment

• Let MA announce:
  – we will be more expansionary even after LT conditions have ended
  – Keep r=0 with probability μ’

• How does this impact on effects of fiscal policy?

• Answer in this model: - almost eliminates need for fiscal expansion (look at v=1 case)
Figure 2

Optimal $\mu'$